

U.S. Patent Application Serial No. 10/827,059
Filed: April 19, 2004, Inventor: James Wagner Larsen
For: Systems and Methods Useful For Detecting Presence
And/Or Location Of Various Materials
Attorney: James L. Ewing, IV, Telephone: 404.915.6494
Attorney Docket No. 14083/399978
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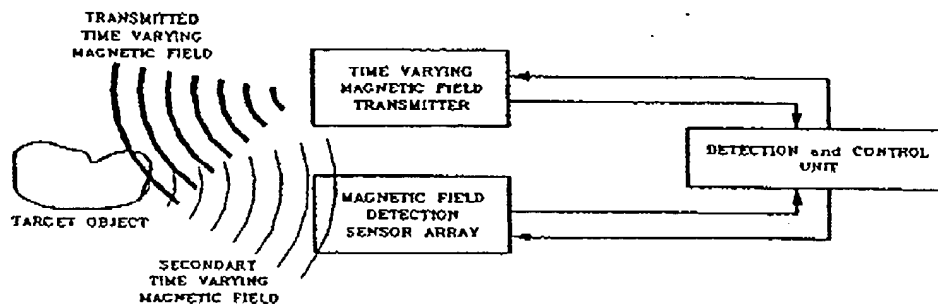


FIGURE 1-1 SYSTEM BLOCK DIAGRAM

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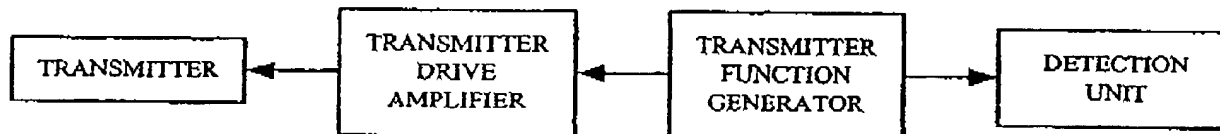


FIGURE 1-2
TRANSMITTER WITH KNOWN OUTPUT FUNCTION

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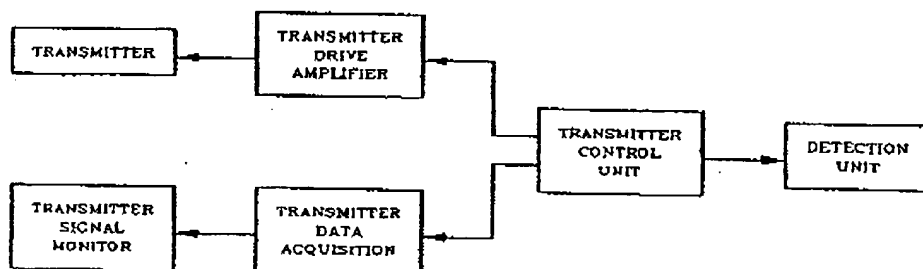


FIGURE 1~3
TRANSMITTER WITH MAGNETIC FIELD MONITOR

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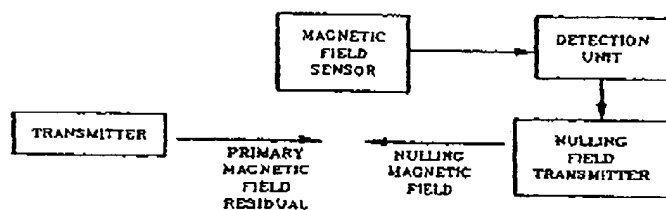


FIGURE 1-4A
RESIDUAL MAGNETIC FIELD NULLING
USING A NULLING MAGNETIC FIELD

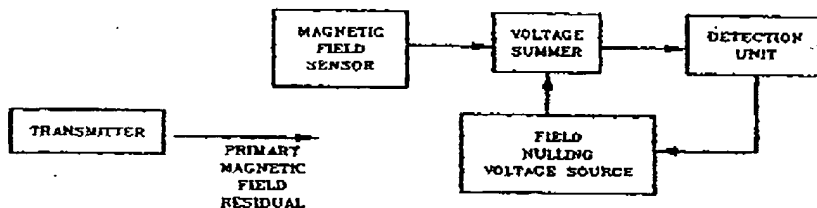


FIGURE 1-4B
VOLTAGE NULLING OF RESIDUAL FIELD SENSOR OUTPUT

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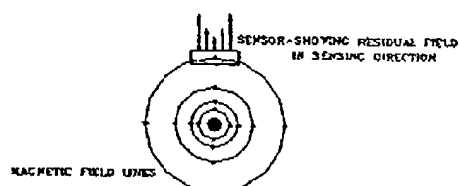


FIGURE 1-5A
TRANSMITTER COIL CROSS SECTION FOR SINGLE WIRE COIL
SHOWING SENSOR POSITION AND RESIDUAL FIELD

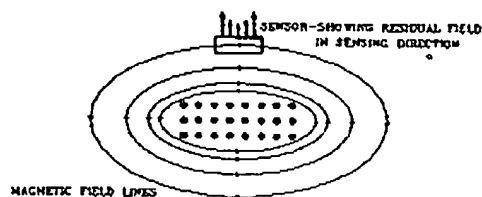


FIGURE 1-5B
TRANSMITTER COIL CROSS SECTION FOR NORMAL RECTANGULAR COIL
SHOWING SENSOR POSITION AND RESIDUAL FIELD

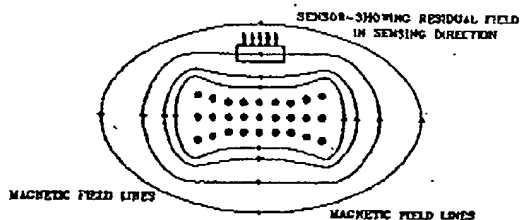


FIGURE 1-5C
TRANSMITTER COIL CROSS SECTION FOR SHAPED COIL
SHOWING SENSOR POSITION AND RESIDUAL FIELD

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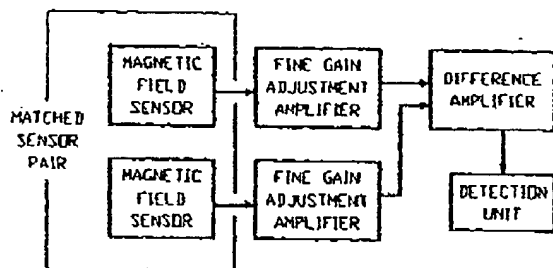


FIGURE 1-6
GRADIENT SENSING USING A MATCHED SENSOR PAIR

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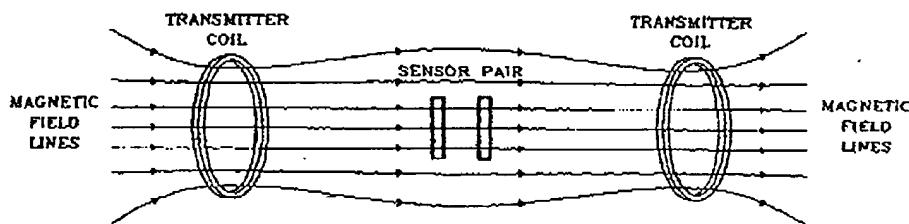


FIGURE 1-7
SENSOR PAIR CALIBRATION
USING TWO TRANSMITTER EQUAL COILS

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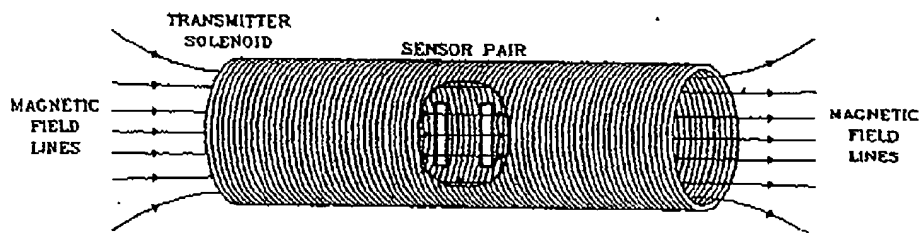


FIGURE 1-8
SENSOR PAIR CALIBRATION
USING A LARGE SOLENOID COIL

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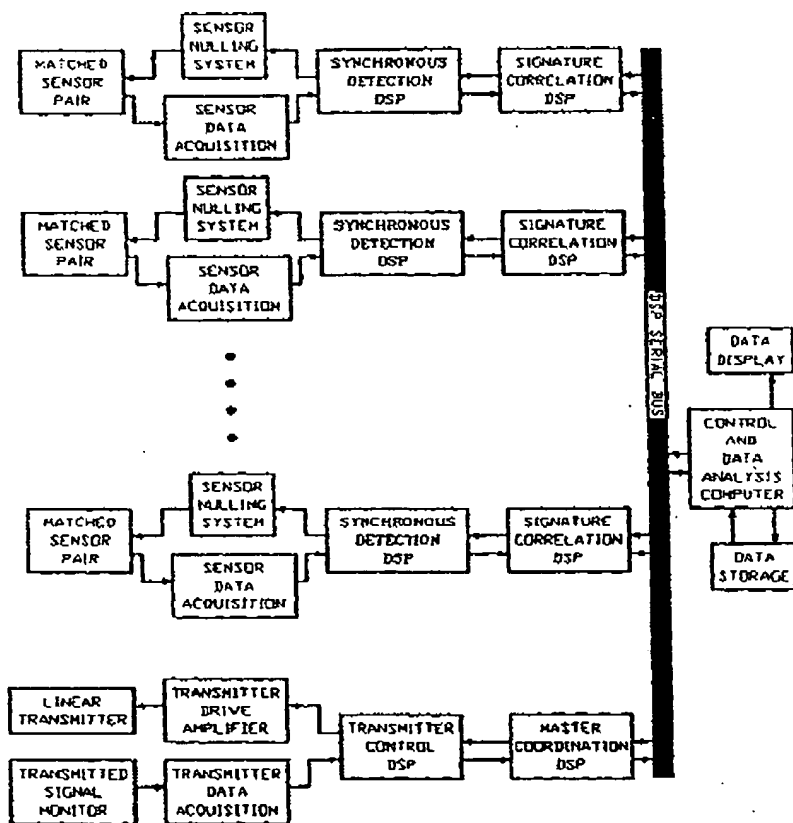


FIGURE 1-9
 SYSTEM WITH MULTIPLE SENSOR PAIRS
 AND SYNCHRONOUS DETECTION
 BASED ON DSP PROCESSORS

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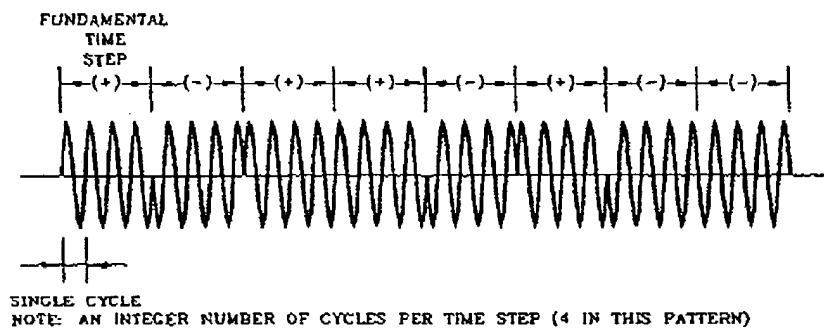


FIGURE 1-10
AN 8 SECTION (+ - + + - + - -)
TIME ENCODED WAVEFORM

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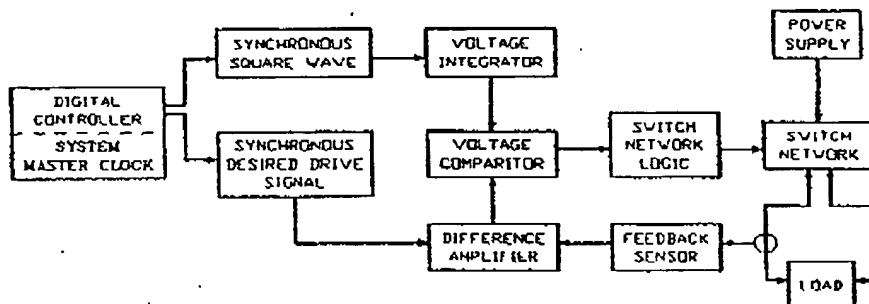


FIGURE 2-1
SYNCHRONOUS PULSE WIDTH MODULATION AMPLIFIER

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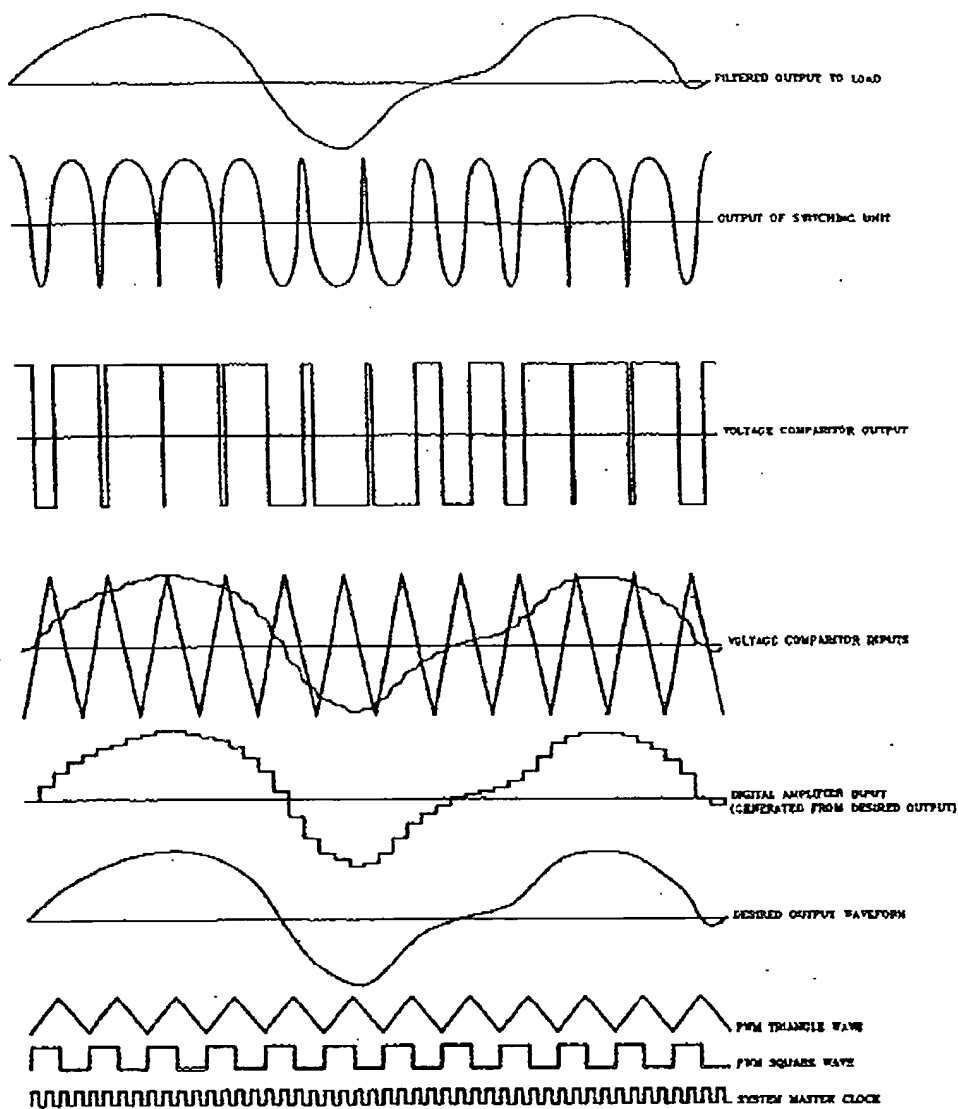


FIGURE 2-2
TYPICAL PULSE WIDTH MODULATION WAVEFORMS

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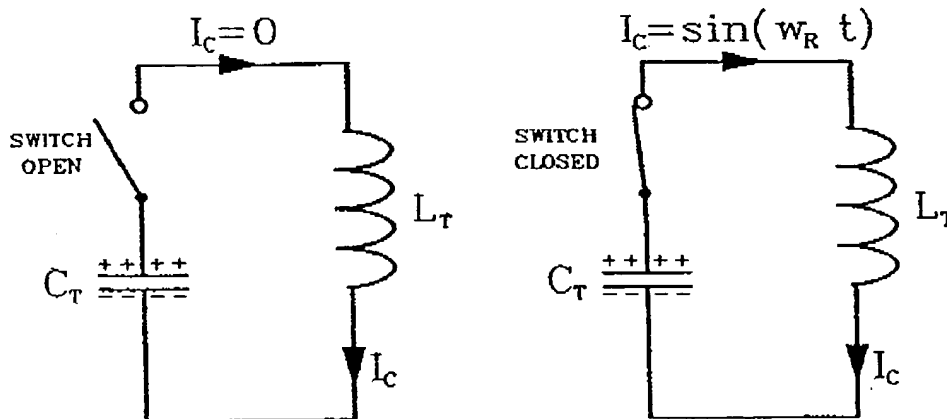


FIGURE 4-1
WHEN SWITCH IS CLOSED CIRCUIT OSCILLATES
AT RESONANT FREQUENCY, ω_R

U.S. Patent Application Serial No. 10/327,089
Filed: April 19, 2004, Inventor: James Wagner Larsen
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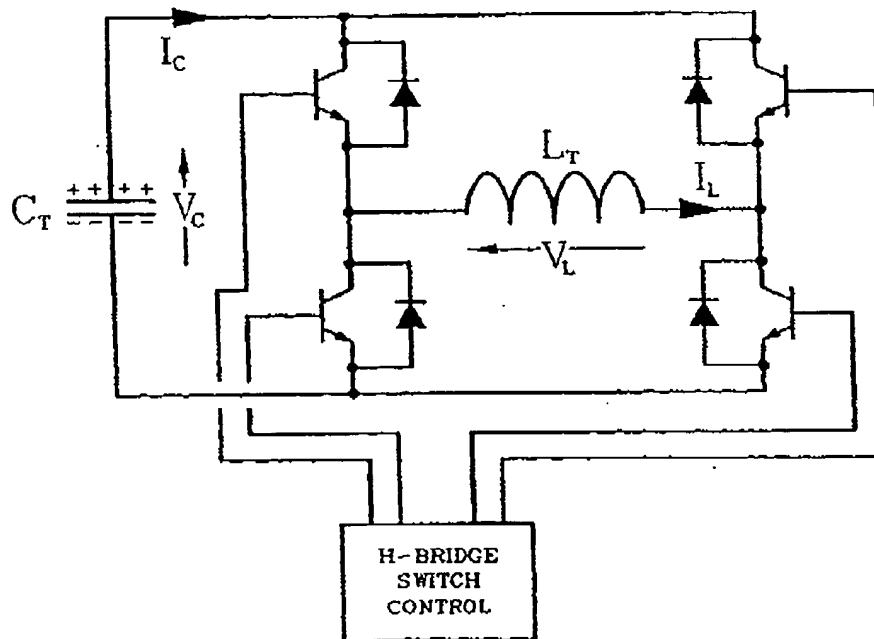


FIGURE 4-2
AN H-BRIDGE SWITCH NETWORK
CONNECTING THE CHARGED CAPACITOR
TO THE LOAD COIL

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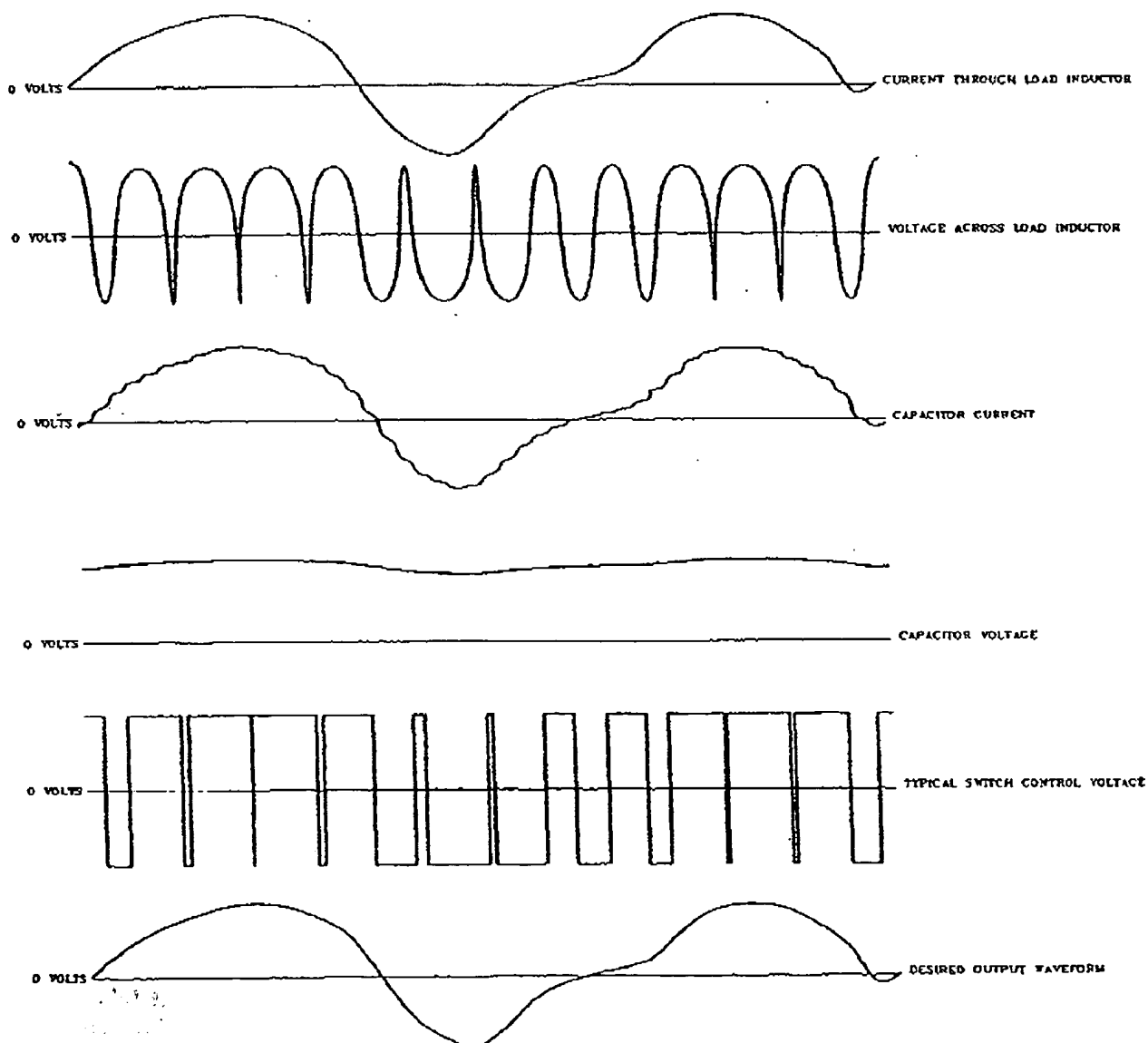


FIGURE 4-3
SWITCHED CAPACITOR CIRCUIT WAVEFORMS

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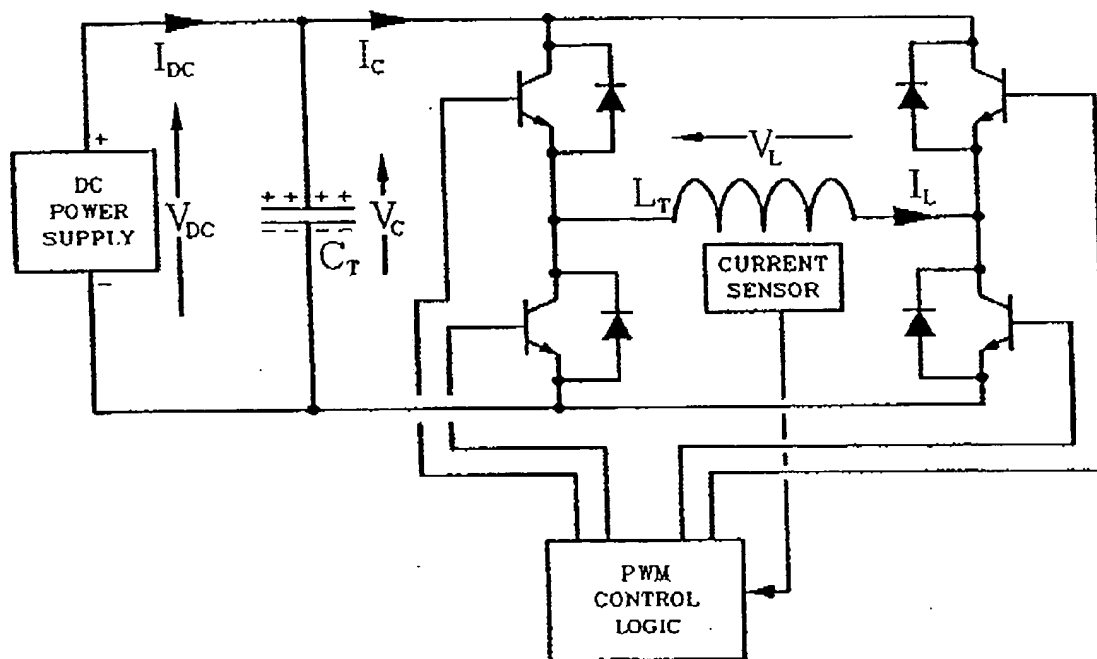


FIGURE 4-4
PULSE WIDTH MODULATED
SWITCHED CAPACITOR RESONATOR

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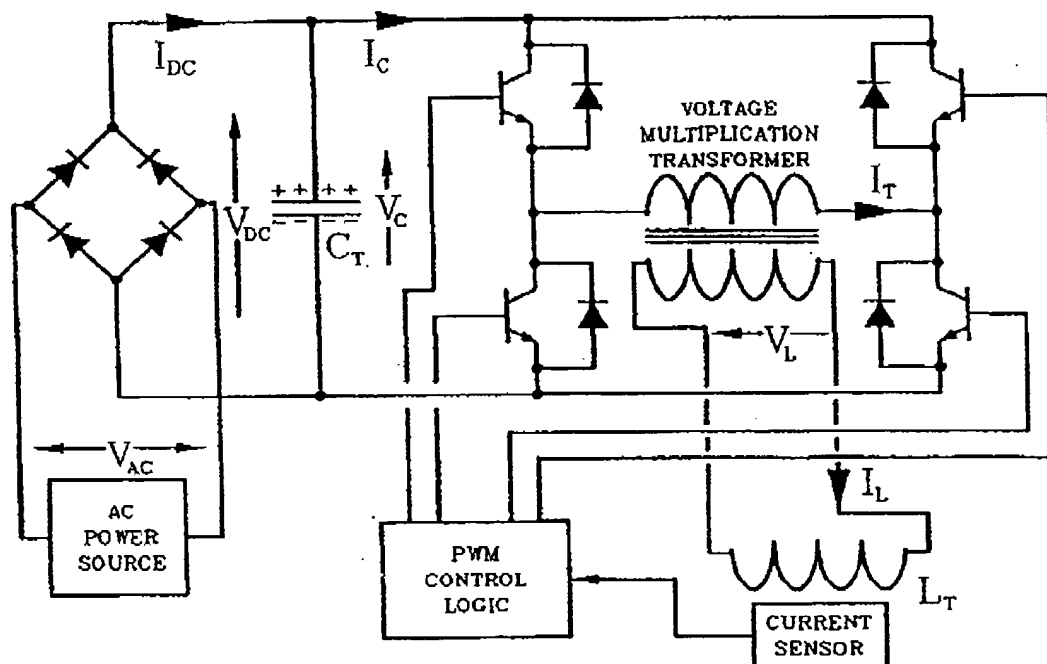


FIGURE 4-5
 SWITCHED CAPACITOR RESONATOR
 WITH INTEGRAL SWITCHING POWER SUPPLY

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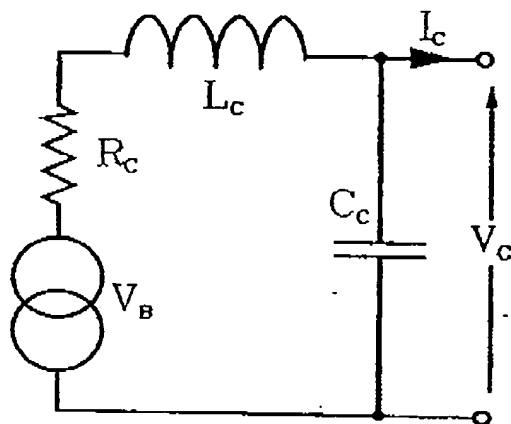


FIGURE 5-1
SENSE COIL EQUIVALENT CIRCUIT

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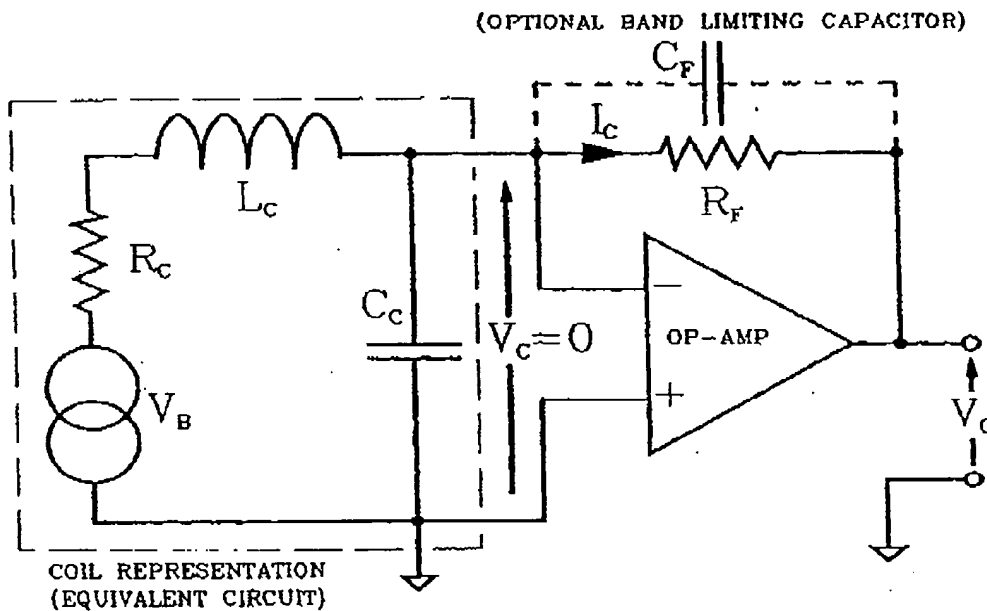


FIGURE 5-2

OPERATIONAL AMPLIFIER BASED
 VOLTAGE TO CURRENT CONVERSION CIRCUIT

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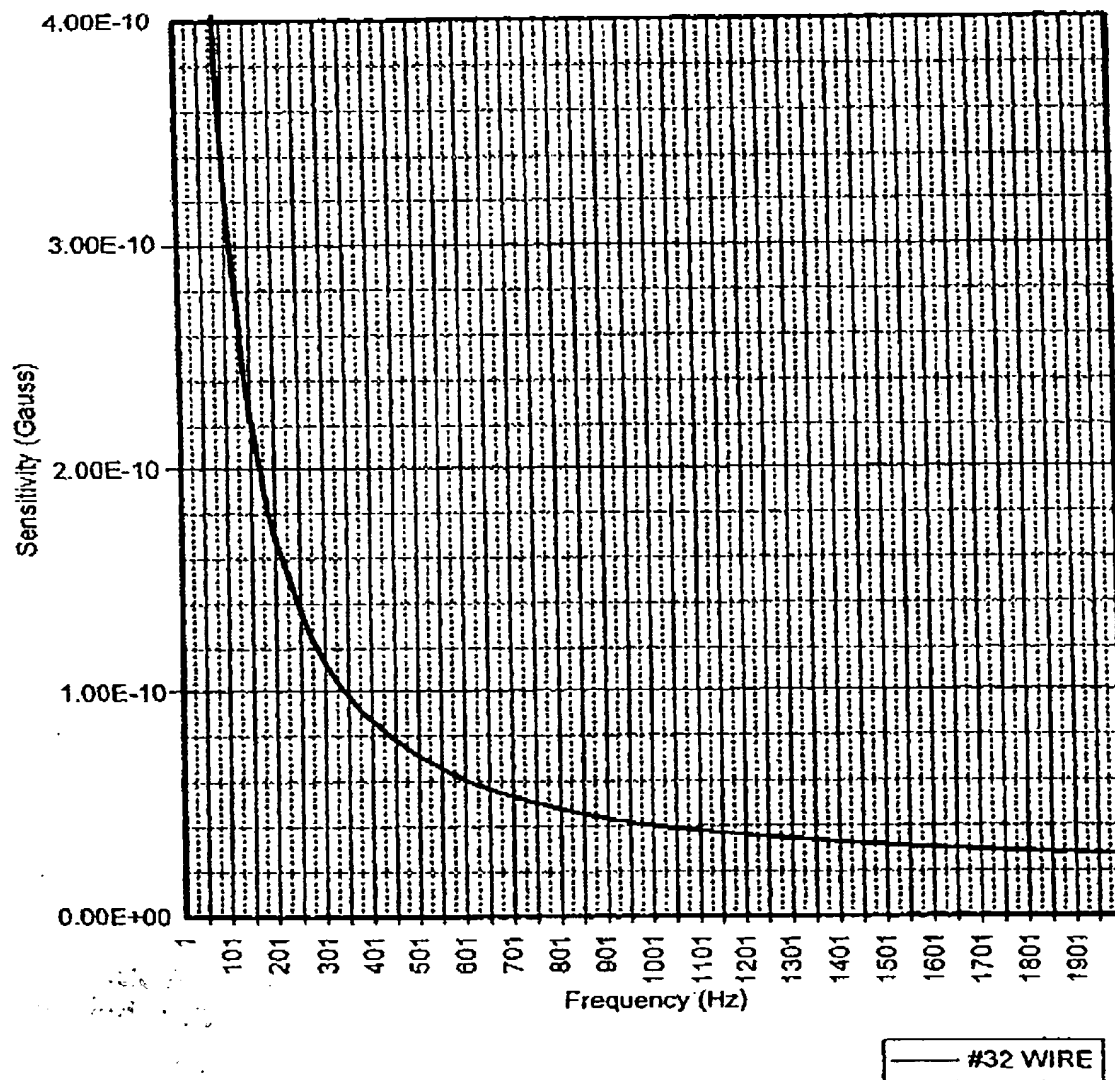
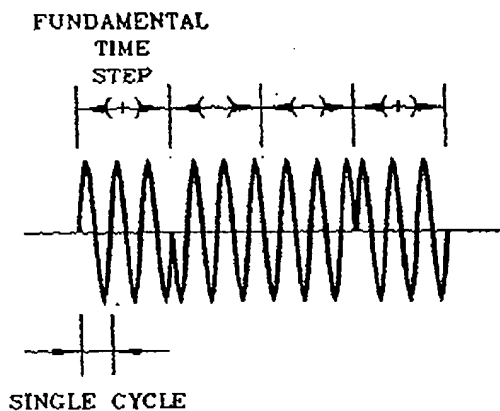
SENSITIVITY FOR #32 WIRE WITH $R_f + 10M\Omega$ 

FIGURE 5-3

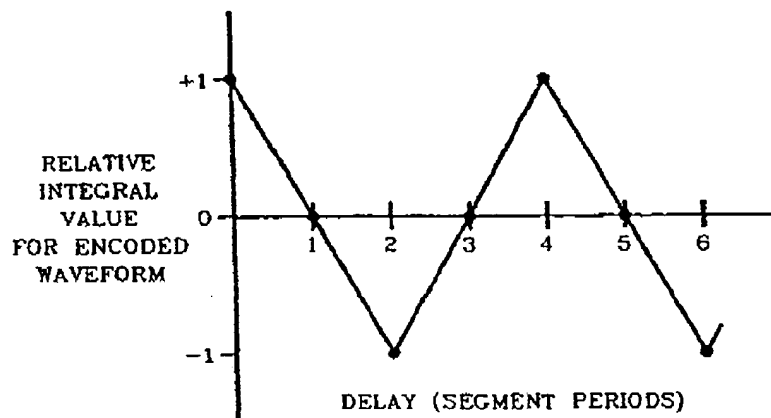
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NOTE: AN INTEGER NUMBER OF CYCLES PER TIME STEP
(3 IN THIS PATTERN)

FIGURE 6-1
A 4 SEGMENT (+ - - +)
TIME ENCODED WAVEFORM

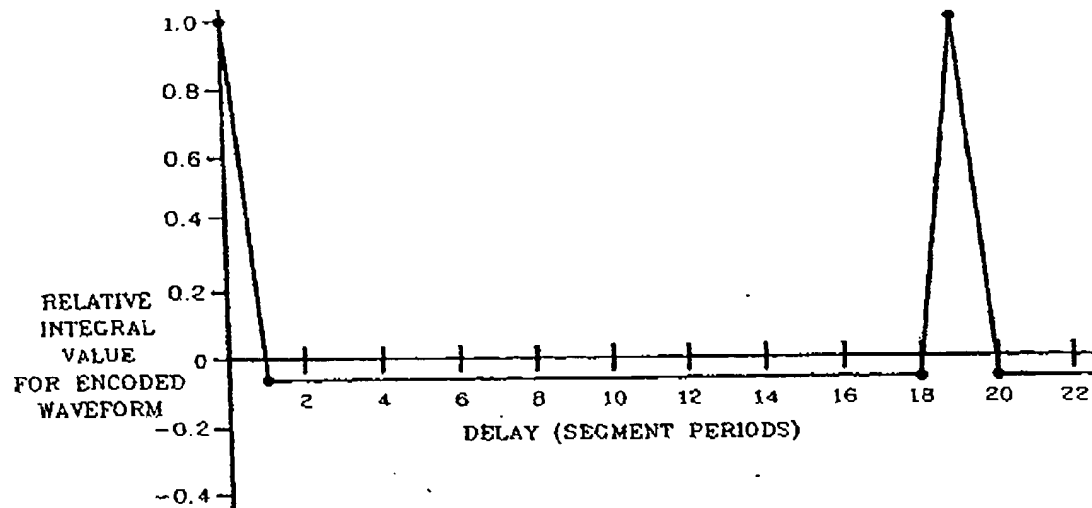
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NOTE: THE INTEGRAL OF THIS WAVEFORM WITH A CONTINUOUS SINE WAVE IS ZERO

FIGURE 6-2
CORRELATION OF THE 4 SEGMENT (+ - - +)
ENCODED WAVEFORM WITH ITSELF

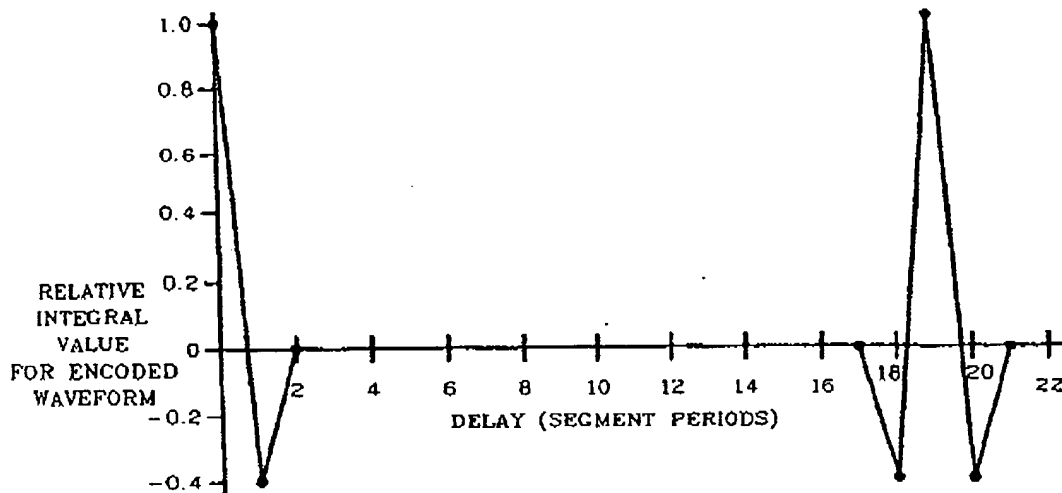
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NOTE: THE INTEGRAL OF THIS WAVEFORM WITH A CONTINUOUS SINE WAVE IS 0.0526

FIGURE 6-3
CORRELATION OF THE 19 SEGMENT
(++++--++--++--++--++--++--++--++--)
ENCODED WAVEFORM WITH ITSELF

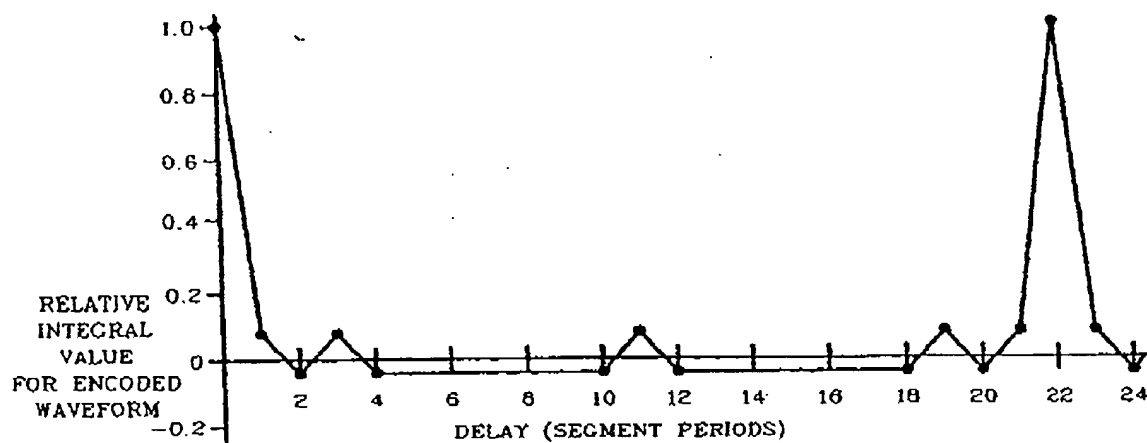
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 Filed: April 19, 2004, Inventor: James Wagner Larsen
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NOTE: THE INTEGRAL OF THIS WAVEFORM WITH A CONTINUOUS SINE WAVE IS -0.1

FIGURE 6-4
 CORRELATION OF THE 20 SEGMENT
 (+ - - - + + - - + - - + - + + - + - + -)
 ENCODED WAVEFORM WITH ITSELF

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NOTE: THE INTEGRAL OF THIS WAVEFORM WITH A CONTINUOUS SINE WAVE IS ZERO

FIGURE 6-5
CORRELATION OF THE 22 SEGMENT
(++++-----+-+--+---++)
ENCODED WAVEFORM WITH ITSELF

U.S. Patent Application Serial No. 10/527,089
Filed: April 19, 2004, Inventor: James Wagner Larsen
For: Systems and Methods Useful For Detecting Presence
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Attorney Docket No. 14058/299978
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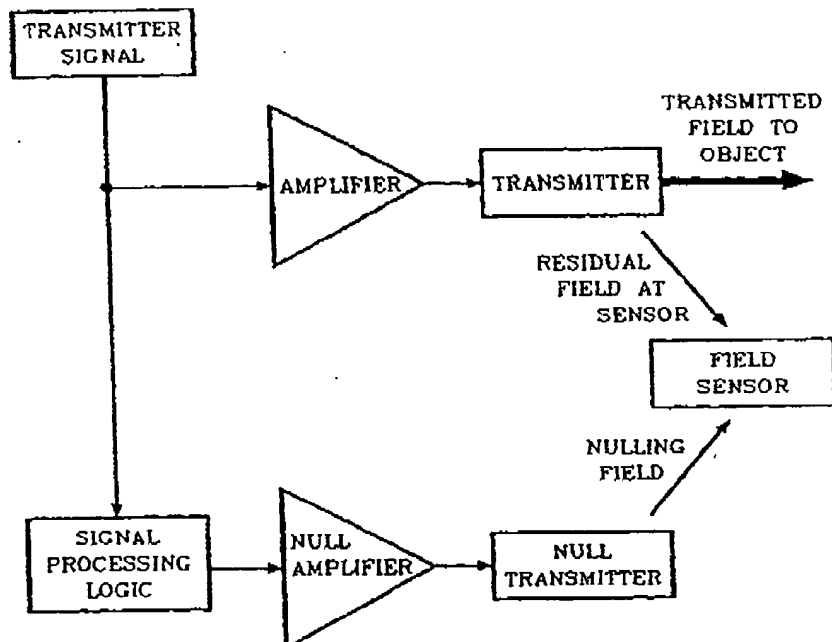


FIGURE 7-1
LOCAL MAGNETIC FIELD GENERATION
FOR RESIDUAL FIELD CANCELLATION

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